



Rubber dam isolation – key to success in diastema closure technique with direct composite resin

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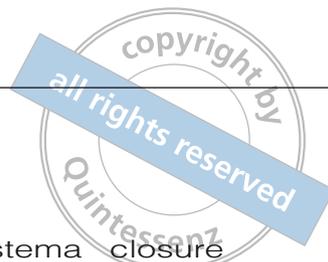
Abstract

The use of direct composite resin for diastema closure has technique advantages, including that the restorative procedure can be carried out in one appointment at a reasonable cost and without the removal of sound tooth structure. The use of a rubber dam for closing diastemas with composite resin is of paramount importance as it prevents moisture contamination and ensures increased gingival retraction compared to

other techniques. This provides better access to the cervical area of the tooth, facilitating proper placement of resin to recreate the natural anatomical contours and contact point. Thus, there is a more natural adaptation of the restoration to the gingival tissue, avoiding a space between the papilla and the restored tooth. To illustrate the advantages of this technique, two diastema closure cases are presented using direct composite resin with rubber dam isolation.

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Introduction

The demand for esthetic excellence in dental care has increased in recent years¹ due to the high expectations of patients, who want to have beautiful smiles.² Dental professionals need to strive for continuous improvement in order to offer esthetic solutions that satisfy these expectations.

Diastemas are characterized by the presence of interdental spaces that can be seen to constitute an inharmonious factor in a patient's smile.³ These spaces can be classified as pathological, physiological or from the palatine disjunction. The physiological spacing commonly occurs during the primary dentition stage, while the pathological one can have numerous etiologies, such as atypical insertion brake lip, agenesis, microdontia, absence of a maxillary lateral incisor, presence of mesiodens, periodontal disease, and deleterious habits.⁴ The presence of diastemas in populations varies according to gender, age, and facial shape. Diastemas are more prevalent in females, more common between the ages of 14 and 34, and occur more in mesofacial patients who have balanced facial growth.⁵ Therefore, a careful examination and the correct diagnosis of diastemas helps the clinician to make the appropriate treatment choice.⁶

Options to resolve diastemas can involve various specialties, including operative dentistry, orthodontics, and prosthodontics. The main advantages of treatment through the direct procedures of operative dentistry include simplicity, predictability, speed, and low cost,⁶ with reversible and almost imperceptible re-

sults. Orthodontic diastema closure requires fixed orthodontic braces, involving the greatest amount of time and cost.¹ Closure of diastemas with porcelain veneers or crowns also provides excellent results; however, because it is an indirect procedure, it requires more invasive removal of tooth structure and is more expensive than direct procedures.^{7,8}

An interdisciplinary approach can be taken, as in cases where orthodontic treatment is carried out to align the teeth correctly for proper occlusion and size, and then space closure is finalized using direct or indirect procedures. According to the current concept of minimally invasive dentistry, the more conservative treatment should always be prioritized by professionals.⁹ Orthodontics is a conservative treatment but can be difficult due to the individual characteristics of each patient's teeth, such as shape, size, height/width ratio, and other factors.¹⁰ Restorative procedures using direct bonding with composite resin create esthetic restorations without the removal of healthy tooth structure, and can improve some of the individual characteristics.¹¹

Recent clinical studies have demonstrated excellent results with direct composite restorations based on the biological, functional, and esthetic aspects of the closure of interdental spaces.^{12,13} These results are mainly due to the development of the adhesive techniques and compositions of these systems, as well as improved composite resin materials.

One consequence of a diastema between the maxillary central incisors is the absence of the interdental papilla. The



distance between the interdental contact point of these teeth and the alveolar bone crest has significant influence in interdental papilla presence. In a study conducted in 1992, this distance was estimated for 200 interproximal sites, and the following results were obtained: when the distance was less than 5 mm, the papilla was 100% present in almost all cases; when it was 6 mm, the papilla was present in 56% of cases; and when it was 7 mm or more, it was present in only 27% or less of cases.¹⁴

Despite the numerous treatment options, the factors that are essential for obtaining a successful result are good diagnosis and treatment planning (including functional assessment), evaluation of teeth measurements, dental positioning, phonetic evaluation, and preparation of a diagnostic wax-up.

Clinical case descriptions

Case 1

A 22-year-old Caucasian female patient presented for esthetic enhancement of her smile. Clinical examination revealed the presence of a diastema between the maxillary central incisors. After the patient's medical and dental histories were reviewed, a clinical and radiographic examination was performed. A smile analysis was done, which included an assessment of tooth size relationships. The teeth were found to have a small mesiodistal width in relation to the cervicoincisal dimension (Figs 1 and 2). The recommended treatment plan involved closing the diastema with composite resin, thus increasing the



Fig 1 Preoperative smile view.



Fig 2 Note the small mesiodistal width in relation to the cervicoincisal dimension.



Fig 3 Cervicoincisal height (blue line); gingival papilla level (pink line).

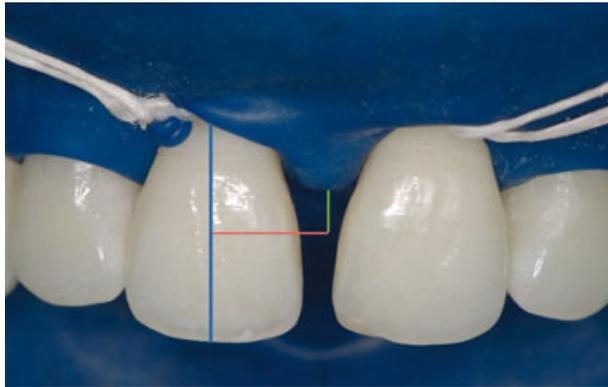


Fig 4 Cervicoincisal height (blue line); gingival papilla level before rubber dam (red line); space obtained by gingival tissue retraction (green line).

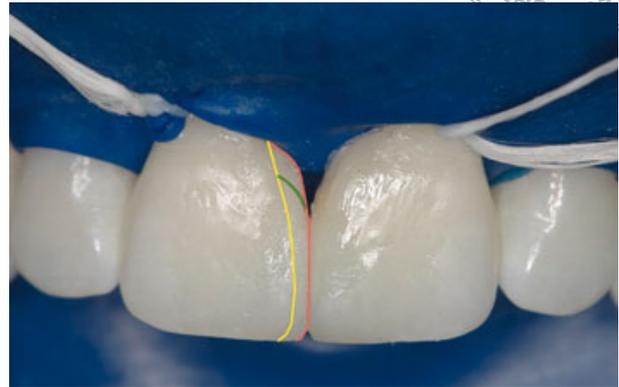


Fig 5 Volume of resin corresponding to the space achieved by papilla retraction with rubber dam isolation. Embrasure and proximal tooth surface inclination before restoration (yellow line); embrasure and proximal tooth surface inclination without absolute isolation (green line); embrasure and proximal tooth surface inclination after the restoration (pink line).

mesiodistal dimension of the incisors without damaging tooth structure, while achieving the ideal esthetic proportions, ie, tooth width between 75% and 85% of tooth height.¹⁵ Measurements were made using a digital caliper. Reference points for the desired proximal contact in the final restorations were based on the ideal distance between the incisal edge and the gingival papilla, to ensure that the interdental papilla would naturally form between the cervical contours of the restored teeth. This also required that this contact be 4 mm or less from the interdental crestal bone level (Fig 3).

The next step in planning the restorations was color mapping. The shade selection was made by first choosing chromaticity, then value and opalescence. The chromaticity is the dentin color, which should be chosen at the middle and cervical thirds of the tooth. The value is the brightness, which should be determined at the middle third of the

tooth, while opalescence is based on enamel incisal characteristics.¹⁶

Shade selection was performed while the teeth were still moist to facilitate an accurate determination of color. The operative field was isolated with rubber dam to permit ideal moisture control for an adhesive dental procedure, as well as to allow greater gingival retraction (Fig 4), provide the correct space for interproximal contact, and allow composite addition with a gradual contour similar to that of the natural tooth (Fig 5).

A total-etch technique was selected for the bonding procedure. Each tooth was etched with 35% phosphoric acid for 15 s, rinsed with water, then gently air dried. The adhesive system Single Bond 2 (3M ESPE) was then applied according to manufacturer's instructions, and polymerized for 20 s. The diastema was closed by freehand technique using multiple layers and the "pull trough" technique from lingual to facial with clear celluloid matrix, placing and sculpting



Fig 6 A small black triangle at the apex of the interdental papilla.



Fig 7 Another image showing the small black triangle in the interdental space.

the nanohybrid composite (Opallis, shades A1/T-Neutral/VH; FGM) to teeth 8 and 9 to achieve the desired restorative outcome. The resin material was contoured using composite resin instruments (Suprafill 2, SS White) and artist's Sable Touch Brush 486 No. 4 (Tigre). A "free" polychromatic incremental layering technique was used for the direct composite buildup; each increment of nanohybrid composite was light-cured for 20 s using a blue LED light source (SmartLite PS, Dentsply) at an intensity of 950 mW/cm² and a wavelength range of 450 to 490 nm to ensure adequate polymerization.

Using the technique described above, after the first tooth buildup (mesial of tooth 11), finishing was done with a surgical blade No. 12, followed by a pre-polish with ultrafine finishing discs (3M ESPE) and rubber finishing cups and points (Edenta). These steps generated some debris on the surface of the first restoration and after the removal of

an air-inhibited layer. The second restoration therefore did not adhere to the adjacent tooth. After the conclusion of the first buildup, the second (mesial of tooth number 21) was done initially by creating a thin wall of dental composite that touched the adjacent tooth. To separate them, after polymerization of this increment, a small torque with an IPC or similar instrument is sometimes necessary to achieve the correct matrix placement and to pull through the composite in the same way as the first restoration, creating the proximal contact, with both restorations able to receive the immediate final finishing and polishing.

In addition to offering absolute field control, rubber dam isolation provides excellent gingival retraction compared to other techniques, such as the use of retraction cord. This helps to obtain a smoother contour between the restored cervical and proximal surfaces. Proper contouring of the gingival embrasure provides a smaller, more ideal space

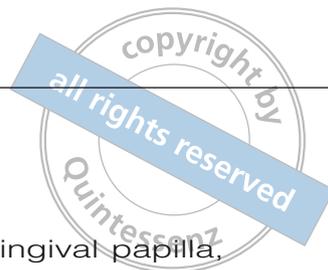


Fig 8 The papilla 1 week after the restoration, nearly filling the gingival embrasure.



Fig 9 Six months later, observe the final aspect of the restorative treatment. An adequate balance between soft and hard tissues is evident.



Fig 10 Final result at 6-month clinical follow-up.

to be occupied by the gingival papilla, which is then slightly compressed to fill the entire interdental space in the final restoration.

Figure 5 shows that without rubber dam isolation and retraction, the resin addition might follow the outline indicated by the green line, forming a step in relation to the original tooth contour (yellow line). By using the isolation and retraction offered by the rubber dam, it is possible to obtain a more appropriate contact and symmetrical contours in the final restoration (pink line).

The rubber dam was removed and the restorations finished using diamond burs (2200 F and 3168 F, KG Sorensen), a No. 12 blade, ultrafine finishing discs (3M ESPE), and rubber finishing cups and points (Edenta).

Once the restorations were finished, a small black triangle was observed at the apex of the interdental papilla (Figs 6 and 7) due to the gingival tissue not completely filling the embrasure. The appearance of the papilla 1 week later showed that it had nearly filled the gingival embrasure (Fig 8), and after 6 months the papilla occupied the entire space (Figs 9 and 10).

Upon completion of the restorative work, the patient was given instructions regarding oral hygiene and maintenance of the restorations. The patient was cautioned regarding harmful habits (such as biting the lips or hard objects, nail biting, opening objects with the teeth, etc), and it was emphasized that proper care is closely related to treatment longevity.¹⁷

Case 2

A 23-year-old Caucasian male patient presented for esthetic enhancement of his smile. Clinical examination revealed the presence of a diastema between the maxillary central incisors. During examination and case analysis, it was observed that inadequate proximal contours existed in the restoration, resulting in a black triangle with the absence of an adequate interdental papilla (Fig 11).

After color mapping of the teeth had been performed, the proximal restorations were removed (Fig 12). Total isolation of the maxillary anterior teeth was achieved using rubber dam (Fig 13), which also allowed for effective gingival retraction. This facilitated the completion of a new restoration with ideal contour and contacts.

To enhance isolation, the rubber dam was ligated at the cervix of each tooth using dental floss.

For this case, the restorative procedure also made use of the freehand technique and continued according to the exact same steps as described for the previous case: acid etching, the application of the Single Bond 2 adhesive system according to the manufacturer's instructions, and the placement of composite resin (Opallis).

The newly completed restoration not only reproduced the ideal contours and contact of the teeth, but also provided esthetic improvement by modifying the angle between the cervical and proximal surface to close the gingival embrasure (Figs 14 and 15) in a manner that provided proper space for the interdental papilla to fill the embrasure for a natural and esthetic result.



Fig 11 Preoperative smile view. Observe the inadequate proximal contours in the restoration, which resulted in a black triangle with the absence of an adequate interdental papilla.



Fig 12 After the proximal restorations had been removed.



Fig 13 Total rubber dam isolation of the maxillary anterior teeth.



Fig 14 The newly completed restorations reproducing the ideal contours and contact of the teeth, and resulting in improved esthetics.



Fig 15 Postoperative frontal view. Interdental papilla fills the embrasure for a natural and esthetic result.

Discussion

Given the numerous treatment options, it is thought that restorative material choice is based on several factors, including etiology, economics, time availability, and the patient's desires.¹² The treatment choice for the two cases described in this article was direct bonding with composite resin.

The literature supports a direct approach to diastema closure, with several authors advocating the use of direct composite resin as the material of choice due to its good clinical longevity. Further, a direct approach to diastema closure is a less expensive and less invasive treatment option compared to indirect techniques.¹⁸⁻²¹

The type of composite resin selected depends on the amount and condition of remaining sound tooth structure, as well as the size of the interdental spaces.²² It has been suggested to use microfilled resins in smaller spaces without occlusal contact, and microhybrid and nanoparticle composites in larger spaces or in areas of occlusal contact during excursive movement.¹²

The technique used in the cases presented here uses rubber dam isolation as a means of field control and to achieve gingival retraction for the placement of composite resin. One of the questions regarding rubber dam isolation for closing diastemas is that the rubber might interfere with proper cervical adaptation of the restoration. It is known that composite resin requires a moisture-free environment.¹² Therefore, rubber dam isolation is advantageous to obtain better gingival retraction without moisture contamination, compared to the use of retraction cord.

Obtaining good gingival retraction is crucial to enable composite addition in areas previously occupied by gingival tissue. Proper isolation and retraction is essential to achieve the correct anatomical location of the proximal contact. The proper location of the contact area in relation to the level of the alveolar crest might determine that the interdental papilla will completely fill the gingival embrasure and prevent the unesthetic black triangle that can occur if the proximal contact is located too far incisally. Achieving anatomically correct contact



and contour is essential for the esthetics and longevity of any restorative technique. Thus, rubber dam isolation offers an advantage in adhesive restorative techniques, where a dry and clean surgical field provides the foundation for a long-lasting esthetic restoration.²³

Another factor to be considered is the distance from the proximal contact point and the height of the alveolar bone crest interdentially. The proper location of the contact point in relation to the bone crest avoids the appearance of a black triangle between the teeth and gingival tissue.^{14,23}

The apex of the interdental papilla is used as a reference to determine the optimum height for the contact point. Measurement is made with a probe or digital caliper, measuring from the incisal edge of the tooth to the tip of the papilla. These measurements are made to ensure that after the accomplishment of absolute isolation, reference to the contact point location is not lost. Without these procedures, there is the possibility of forming a step between tooth and composite due to a lack of a significant gingival retraction, which is very common in cases where the cord retraction technique is used.^{3,12,24,25}

Another technique requires four sessions to close diastemas. In the first session, the impression is made and the patient model is obtained. The second step takes place in the laboratory, where a scalpel blade is used to carve the region of the papilla, and the space is closed with composite resin, which serves as a provisional restoration to perform a gradual compression of the gingival area. The third step is to anesthetize the patient and cement the restorations, to ensure the conditioning of the papilla. The patient

returns after 1 or 2 weeks for the fourth step, which is the removal of the composite that had been cemented. The spacing is then closed with a new direct composite resin, without using absolute isolation and cord retraction.¹ Although good results are obtained using this technique, it demands more clinical hours. Moreover, sometimes oral hygiene is difficult for patients who have these temporary restorations, and plaque accumulation causes local inflammation, which makes it difficult to obtain an appropriate field.²⁶

Conclusions

In this article, the use of rubber dam isolation for direct diastema closure with composite resin is presented. The advantages of this technique include:

- Needing fewer clinical sessions compared to the technique that uses provisional restorations for gingival retraction.
- Obtaining optimal gingival retraction that is superior to that obtained by using the cord retraction technique.
- Preparing the restoration with appropriate proximal contours and contacts at the tooth restorative interface.
- Greater patient comfort, with invasive techniques such as periodontal surgery being avoided.
- Obtaining excellent field and moisture control.
- Obtaining better access to create proper contact.
- Contours and an emergence profile that mimics the natural tooth and allow accommodation of the natural gingival papilla, thus preventing the appearance of black triangles.



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